

TABLE OF CONTENTS

SECTION 1: OVERVIEW

- 4 Standard Methods for Infectious Diseases**
Zoe Freeman Weiss, MD, Nicole Pecora, MD, PhD, and Shira Winters, MD
- 10 Emerging Techniques**
Jessica Crothers, MD
- 12 Biosafety Considerations**
Jessica Crothers, MD
- 16 Pitfalls and Artifacts**
Jessica Crothers, MD, Alvaro C. Laga, MD, MMSc, and Isaac H. Solomon, MD, PhD

SECTION 2: VIRAL INFECTIONS

DNA VIRUSES

- 22 Herpes Simplex Virus 1 and 2 (HSV-1, HSV-2) Infections**
Isaac H. Solomon, MD, PhD, Leigh Compton, MD, and Dan Milner, MD, MSc(Epi), MBA
- 28 Varicella-Zoster Virus (HHV-3) Infections**
Isaac H. Solomon, MD, PhD, Eleanor Russell-Goldman, MD, PhD, and Dan Milner, MD, MSc(Epi), MBA
- 32 Epstein-Barr Virus (HHV-4) Infection**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 38 Cytomegalovirus (HHV-5) Infections**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 44 Human Herpesvirus 6 and 7 (HHV-6, HHV-7) Infections**
Isaac H. Solomon, MD, PhD
- 46 Kaposi Sarcoma-Associated Herpesvirus (HHV-8) Infection**
Isaac H. Solomon, MD, PhD, Leigh Compton, MD, and Dan Milner, MD, MSc(Epi), MBA
- 52 Herpes B Virus Infection**
Isaac H. Solomon, MD, PhD
- 54 Adenovirus Infection**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 58 Hepatitis B and D Virus Infections**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 62 Parvovirus B19 Infection**
Isaac H. Solomon, MD, PhD, Leigh Compton, MD, and Dan Milner, MD, MSc(Epi), MBA
- 66 JC Virus, BK Virus, and Other Polyomavirus Infections**
Isaac H. Solomon, MD, PhD

- 72 Human Papillomavirus Infection**
Isaac H. Solomon, MD, PhD, T. Rinda Soong, MD, PhD, MPH, and Dan Milner, MD, MSc(Epi), MBA
- 78 Molluscum Contagiosum**
Isaac H. Solomon, MD, PhD
- 80 Smallpox, Mpox, and Other Pox Virus Infections**
Alvaro C. Laga, MD, MMSc, Dan Milner, MD, MSc(Epi), MBA, and Isaac H. Solomon, MD, PhD

RNA VIRUSES

- 86 Arbovirus Infections**
Isaac H. Solomon, MD, PhD
- 92 Zika Virus Infection**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 96 Ebola, Marburg, and Other Hemorrhagic Fever Virus Infections**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 102 Enterovirus Infections**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 104 Poliovirus Infection**
Jessica Crothers, MD and Isaac H. Solomon, MD, PhD
- 106 Rabies Virus Infection**
Isaac H. Solomon, MD, PhD
- 108 Lymphocytic Choriomeningitis Virus Infection**
Isaac H. Solomon, MD, PhD
- 110 Measles Virus Infection**
Isaac H. Solomon, MD, PhD
- 112 Mumps Virus Infection**
Isaac H. Solomon, MD, PhD
- 114 Rubella Virus Infection**
Isaac H. Solomon, MD, PhD
- 116 Human Immunodeficiency Virus Infection**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 120 Human T-Lymphotropic Virus Type I Infection**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 122 Influenza Virus Infections**
Isaac H. Solomon, MD, PhD
- 126 Parainfluenza Virus Infections**
Isaac H. Solomon, MD, PhD
- 128 Coronavirus Disease 2019 (COVID-19)**
Isaac H. Solomon, MD, PhD
- 134 Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), and Other Coronavirus Infections**
Isaac H. Solomon, MD, PhD

TABLE OF CONTENTS

- 136 **Respiratory Syncytial Virus Infection**
Isaac H. Solomon, MD, PhD and Eleanor Russell-Goldman, MD, PhD
- 138 **Rhinoviruses, Human Metapneumovirus, and Other Respiratory Virus Infections**
Isaac H. Solomon, MD, PhD
- 140 **Rotavirus, Norovirus, and Astrovirus Infections**
Isaac H. Solomon, MD, PhD
- 142 **Hepatitis A and E Virus Infections**
Isaac H. Solomon, MD, PhD
- 146 **Hepatitis C Virus Infection**
Isaac H. Solomon, MD, PhD, Eleanor Russell-Goldman, MD, PhD, and Dan Milner, MD, MSc(Epi), MBA

SECTION 3: PRION DISEASES

- 152 **Transmissible Spongiform Encephalopathies**
Isaac H. Solomon, MD, PhD

SECTION 4: BACTERIAL INFECTIONS

- 158 **Bacterial Classification and Diagnosis**
Nicole Pecora, MD, PhD
- 160 **Botryomycosis**
Isaac H. Solomon, MD, PhD and Malak Abedalthagafi, MD, MBA
- 162 **Malakoplakia**
Malak Abedalthagafi, MD, MBA and Leigh Compton, MD

GRAM-POSITIVE BACTERIA

- 164 **Actinomycosis**
Isaac H. Solomon, MD, PhD, Nicole Pecora, MD, PhD, and Leigh Compton, MD
- 166 **Bacillus Species Infections**
Zoe Freeman Weiss, MD and Nicole Pecora, MD, PhD
- 170 **Clostridioides and Other Gram-Positive Anaerobes**
Nicole Pecora, MD, PhD and Zoe Freeman Weiss, MD
- 174 **Corynebacterium Species Infections**
Nicole Pecora, MD, PhD
- 178 **Listeria Species Infection**
Zoe Freeman Weiss, MD and Nicole Pecora, MD, PhD
- 180 **Rhodococcus Species Infection**
Zoe Freeman Weiss, MD and Nicole Pecora, MD, PhD
- 182 **Staphylococcus Species Infections**
Zoe Freeman Weiss, MD and Nicole Pecora, MD, PhD
- 188 **Streptococcus and Enterococcus Species Infections**
Zoe Freeman Weiss, MD and Nicole Pecora, MD, PhD
- 192 **Whipple Disease**
Jessica Crothers, MD, Dan Milner, MD, MSc(Epi), MBA, and Isaac H. Solomon, MD, PhD

GRAM-NEGATIVE BACTERIA

- 196 **Pathologically Important Enterobacterales: Escherichia, Shigella, Salmonella, Klebsiella, and Yersinia Species Infections**
Nicole Pecora, MD, PhD and Zoe Freeman Weiss, MD
- 204 **Fastidious Organisms: Brucella, Francisella, Haemophilus, and Legionella Species Infections**
Nicole Pecora, MD, PhD

- 210 **Nonfermentative Organisms: Acinetobacter, Burkholderia, and Pseudomonas Species Infections**
Zoe Freeman Weiss, MD, Nicole Pecora, MD, PhD, and Lenette Lu, MD, PhD
- 216 **Bacteroides, Fusobacterium, and Other Gram-Negative Anaerobes**
Zoe Freeman Weiss, MD and Nicole Pecora, MD, PhD
- 220 **Bartonella Species Infections**
Isaac H. Solomon, MD, PhD and Alvaro C. Laga, MD, MMSc
- 222 **Campylobacter and Vibrio Species Infections**
Zoe Freeman Weiss, MD and Nicole Pecora, MD, PhD
- 226 **Helicobacteriosis**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 228 **Neisseria and Moraxella Species Infections**
Nicole Pecora, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 232 **Pertussis**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 234 **Intestinal Spirochetosis**
Isaac H. Solomon, MD, PhD, Leigh Compton, MD, and Nicole Pecora, MD, PhD
- 236 **Borrelia Species Infections**
Isaac H. Solomon, MD, PhD and Nicole Pecora, MD, PhD
- 240 **Leptospira Species Infection**
Isaac H. Solomon, MD, PhD and Nicole Pecora, MD, PhD
- 242 **Syphilis and Other Treponematoses**
Alvaro C. Laga, MD, MMSc, Isaac H. Solomon, MD, PhD, and Dan Milner, MD, MSc(Epi), MBA
- 248 **Anaplasmosis and Ehrlichiosis**
Isaac H. Solomon, MD, PhD, Nicole Pecora, MD, PhD, and Lenette Lu, MD, PhD
- 252 **Chlamydophila and Chlamydia Species Infections**
Nicole Pecora, MD, PhD
- 256 **Coxiella Species Infection**
Isaac H. Solomon, MD, PhD and Nicole Pecora, MD, PhD
- 258 **Rickettsia and Orientia Species Infections**
Isaac H. Solomon, MD, PhD and Nicole Pecora, MD, PhD
- 262 **Mycoplasma and Ureaplasma Species Infections**
Zoe Freeman Weiss, MD and Isaac H. Solomon, MD, PhD

ACID-FAST BACTERIA

- 264 **Mycobacterium tuberculosis Complex Infections**
Nicole Pecora, MD, PhD, Isaac H. Solomon, MD, PhD, and Dan Milner, MD, MSc(Epi), MBA
- 270 **Leprosy**
Malak Abedalthagafi, MD, MBA, Dan Milner, MD, MSc(Epi), MBA, and Isaac H. Solomon, MD, PhD
- 274 **Buruli Ulcer**
Alvaro C. Laga, MD, MMSc
- 276 **Mycobacterium avium Complex and Other Nontuberculous Mycobacterial Infections**
Nicole Pecora, MD, PhD and Zoe Freeman Weiss, MD
- 280 **Nocardiosis**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA

TABLE OF CONTENTS

SECTION 5: FUNGAL INFECTIONS

286 Fungal Classification and Diagnosis

Alvaro C. Laga, MD, MMSc and Dan Milner, MD, MSc(Epi), MBA

MOLDS

290 Aspergillosis

Zoe Freeman Weiss, MD, Alvaro C. Laga, MD, MMSc, and Isaac H. Solomon, MD, PhD

296 Entomophthoramycesis

Alvaro C. Laga, MD, MMSc

300 Fusariosis

Alvaro C. Laga, MD, MMSc, Zoe Freeman Weiss, MD, and Nicole Pecora, MD, PhD

302 Mucormycosis

Zoe Freeman Weiss, MD, Alvaro C. Laga, MD, MMSc, and Isaac H. Solomon, MD, PhD

306 Mycetoma

Alvaro C. Laga, MD, MMSc, T. Rinda Soong, MD, PhD, MPH, and Brian J. Hall, MD

310 Phaeohyphomycosis

Alvaro C. Laga, MD, MMSc, Dan Milner, MD, MSc(Epi), MBA, and Isaac H. Solomon, MD, PhD

312 Scedosporiosis and Lomentosporiosis

Alvaro C. Laga, MD, MMSc, Zoe Freeman Weiss, MD, and Eleanor Russell-Goldman, MD, PhD

314 Scopulariopsis Infections

Zoe Freeman Weiss, MD, Alvaro C. Laga, MD, MMSc, and Eleanor Russell-Goldman, MD, PhD

316 Tinea

Malak Abedalthagafi, MD, MBA, Leigh Compton, MD, and Isaac H. Solomon, MD, PhD

318 Trichosporonosis

Isaac H. Solomon, MD, PhD, Alvaro C. Laga, MD, MMSc, and Dan Milner, MD, MSc(Epi), MBA

320 Superficial Mycoses

Alvaro C. Laga, MD, MMSc

YEAST AND YEAST-LIKE ORGANISMS

324 Blastomycosis

Jessica Crothers, MD

330 Candidiasis

Jessica Crothers, MD, T. Rinda Soong, MD, PhD, MPH, and Isaac H. Solomon, MD, PhD

336 Chromoblastomycosis

Alvaro C. Laga, MD, MMSc, T. Rinda Soong, MD, PhD, MPH, and Nicole Pecora, MD, PhD

340 Coccidioidomycosis

Malak Abedalthagafi, MD, MBA and Isaac H. Solomon, MD, PhD

344 Cryptococcosis

Alvaro C. Laga, MD, MMSc, T. Rinda Soong, MD, PhD, MPH, and Isaac H. Solomon, MD, PhD

350 Histoplasmosis

Alvaro C. Laga, MD, MMSc, T. Rinda Soong, MD, PhD, MPH, and Nicole Pecora, MD, PhD

356 Lobomycosis

Alvaro C. Laga, MD, MMSc

358 Paracoccidioidomycosis

Isaac H. Solomon, MD, PhD and Eleanor Russell-Goldman, MD, PhD

360 Pneumocystosis

Jessica Crothers, MD, Eleanor Russell-Goldman, MD, PhD, and Isaac H. Solomon, MD, PhD

364 Sporotrichosis

Alvaro C. Laga, MD, MMSc, Isaac H. Solomon, MD, PhD, and Dan Milner, MD, MSc(Epi), MBA

368 Talaromycosis

Alvaro C. Laga, MD, MMSc, Dan Milner, MD, MSc(Epi), MBA, and Isaac H. Solomon, MD, PhD

370 Rhinosporidiosis

Alvaro C. Laga, MD, MMSc

372 Protothecosis

Jessica Crothers, MD

SECTION 6: PROTOZOAN PARASITIC INFECTIONS

376 Parasite Classification and Diagnosis

Alvaro C. Laga, MD, MMSc, Isaac H. Solomon, MD, PhD, and Dan Milner, MD, MSc(Epi), MBA

GASTROINTESTINAL AND OTHER LUMINAL PROTOZOA

380 Balantidiasis

Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA

382 Cryptosporidiosis and Other Coccidia Infections

Isaac H. Solomon, MD, PhD, Malak Abedalthagafi, MD, MBA, and Dan Milner, MD, MSc(Epi), MBA

386 Entamebiasis

Malak Abedalthagafi, MD, MBA and Isaac H. Solomon, MD, PhD

390 Giardiasis

Malak Abedalthagafi, MD, MBA, Eleanor Russell-Goldman, MD, PhD, and Isaac H. Solomon, MD, PhD

392 Microsporidiosis

Isaac H. Solomon, MD, PhD, Malak Abedalthagafi, MD, MBA, and Dan Milner, MD, MSc(Epi), MBA

394 Trichomoniasis

Isaac H. Solomon, MD, PhD and T. Rinda Soong, MD, PhD, MPH

INTRAVASCULAR PROTOZOA

396 African Trypanosomiasis

Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA

398 Babesiosis

Malak Abedalthagafi, MD, MBA, Dan Milner, MD, MSc(Epi), MBA, and Lenette Lu, MD, PhD

402 Malaria

Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA

TABLE OF CONTENTS

DEEP TISSUE PROTOZOA

- 408 **Free-Living Amebiasis**
Alvaro C. Laga, MD, MMSc, Isaac H. Solomon, MD, PhD, and Dan Milner, MD, MSc(Epi), MBA
- 414 **American Trypanosomiasis**
Isaac H. Solomon, MD, PhD, Malak Abedalthagafi, MD, MBA, and Eleanor Russell-Goldman, MD, PhD
- 416 **Leishmaniasis**
Malak Abedalthagafi, MD, MBA, Dan Milner, MD, MSc(Epi), MBA, and Isaac H. Solomon, MD, PhD
- 420 **Toxoplasmosis**
Isaac H. Solomon, MD, PhD, Malak Abedalthagafi, MD, MBA, and Dan Milner, MD, MSc(Epi), MBA

SECTION 7: HELMINTHIC PARASITIC INFECTIONS

NEMATODES

- 426 **Ancylostomiasis and Necatoriasis**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 428 **Angiostrongyliasis**
Isaac H. Solomon, MD, PhD
- 430 **Ascariasis**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 434 **Enterobiasis**
Jessica Crothers, MD and Isaac H. Solomon, MD, PhD
- 438 **Gnathostomiasis**
Alvaro C. Laga, MD, MMSc
- 440 **Human Filariasis**
Malak Abedalthagafi, MD, MBA, Isaac H. Solomon, MD, PhD, and Eleanor Russell-Goldman, MD, PhD
- 444 **Onchocerciasis**
Malak Abedalthagafi, MD, MBA
- 446 **Strongyloidiasis**
Malak Abedalthagafi, MD, MBA and Isaac H. Solomon, MD, PhD
- 450 **Trichuriasis**
Isaac H. Solomon, MD, PhD and Dan Milner, MD, MSc(Epi), MBA
- 454 **Trichinellosis**
Jessica Crothers, MD

TREMATODES

- 456 **Clonorchiasis and Opisthorchiasis**
Jessica Crothers, MD
- 460 **Fascioliasis and Fasciolopsiasis**
Jessica Crothers, MD
- 462 **Paragonimiasis**
Jessica Crothers, MD
- 464 **Schistosomiasis**
Dan Milner, MD, MSc(Epi), MBA and Isaac H. Solomon, MD, PhD

CESTODES

- 470 **Coenurosis**
Isaac H. Solomon, MD, PhD
- 472 **Cysticercosis**
Isaac H. Solomon, MD, PhD
- 478 **Diphyllobothriasis and Hymenolepiasis**
Jessica Crothers, MD
- 482 **Echinococcosis**
Dan Milner, MD, MSc(Epi), MBA and Isaac H. Solomon, MD, PhD
- 486 **Sparganosis**
Isaac H. Solomon, MD, PhD

SECTION 8: INFESTATIONS AND OTHER INVERTEBRATE-RELATED MALADIES

- 490 **Tissue Damage From Arachnids and Insects**
Alvaro C. Laga, MD, MMSc, Isaac H. Solomon, MD, PhD, and Dan Milner, MD, MSc(Epi), MBA
- 498 **Myiasis**
Malak Abedalthagafi, MD, MBA and Dan Milner, MD, MSc(Epi), MBA
- 500 **Scabies**
Malak Abedalthagafi, MD, MBA, Leigh Compton, MD, and Dan Milner, MD, MSc(Epi), MBA
- 502 **Demodex Infestations**
Malak Abedalthagafi, MD, MBA and Dan Milner, MD, MSc(Epi), MBA
- 504 **Tungiasis**
Malak Abedalthagafi, MD, MBA and Dan Milner, MD, MSc(Epi), MBA